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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 360.

Experiment Station Work, LI.

Compiled from the Publications of the Agricultural Experiment Stations.

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A. C. TRUE, Director.

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EXPERIMENT STATION WORK.

Edited by W. H. BEAL and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate throughout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practice. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. TRUE, Director, Office of Experiment Stations.

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ILLUSTRATIONS.

NOTE.—A list giving the titles of all Farmers' Bulletins available for distribution will be sent free upon application to a Member of Congress or the Secretary of Agriculture.

EXPERIMENT STATION WORK.[a]

DISTANCE BETWEEN CORN HILLS.[b]

The distance at which corn is planted in check rows has been decreased by several inches since the first machine planters were put upon the market. It has evidently been the opinion of farmers, and agricultural implement manufacturers as well, that the distances formerly used allowed more space than necessary to each hill, and that the number of hills per acre was smaller than could be produced to the best advantage. Distance experiments with corn by the experiment stations and others have been numerous and the results have varied. This would seem to indicate that distance between rows is influenced by different factors, such as soil, season, locality, variety, and that, therefore, no certain distance can be universally the best. Further light has been thrown on this subject by a series of tests conducted from 1903 to 1907 by the Illinois Experiment Station in different sections and on different soils in Illinois. The purpose of this work was to determine the distance at which check rows of corn returned the highest and most profitable yields, and whether planting two kernels per hill at closer distances is better than three kernels at greater distances.

The thickness of planting was varied by increasing or decreasing the distance between rows in both directions. The hills were checked on different plats at distances ranging from 33 to 44 inches, the intermediate distances being 39.6 and 36 inches. The different series were repeated many times each year, in order to equalize differences of soil and season and to make the averages more nearly true. Variations in stand were eliminated so that all parts in the same series were comparable with each other. Attention is called to the fact that with a stand of 100 per cent, hills checked 44 inches apart with two kernels per hill, an acre produces 6,480 stalks; checked 39.6 inches apart, 8,000 stalks; 36 inches apart, 9,680 stalks; and 33 inches apart, 11,520

[a] A progress record of experimental inquiries, published without assumption of responsibility by the department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Illinois Sta. Bul. 126.

stalks. If three kernels instead of two are planted per hill, the number of stalks per acre for the different distances is 9,720, 12,000, 14,520, and 17,280, respectively.

The average results secured in northern Illinois showed that generally on the two-kernel, as well as on the three-kernel, plats, the average yields increased toward the thicker plantings. On the two-kernel plats the average yields for 1904 to 1907, inclusive, increased from 44.1 bushels per acre for the 44 by 44 inches, or widest planting, to 54.3 bushels for the second thickest, or 33 by 36 inch planting, while where three kernels were planted per hill the widest planting produced on an average 54.1 bushels, which increased as the distance was narrowed down to 61 bushels per acre for the closest, or 33 by 33 inch planting. In central Illinois, just as in the experiments carried on in the northern part of the State, the plats planted with two kernels per hill increased in average yield from the widest planting to the second thickest, the yields being 47.7 bushels and 55 bushels per acre, respectively. The plats with three kernels in the hill ranged in average yield per acre from 46.8 bushels for the closest planting to 52.3 bushels for the 39.6 by 39.6 inch and the 36 by 44 inch distances. The plats planted 36 by 36 inches with two kernels per hill yielded 2.2 bushels per acre more than the plats planted 39.6 by 39.6 inches with three kernels per hill.

The yields in these distance experiments were regrouped to determine whether the distance of planting giving the highest yield on land producing more than 50 bushels will also give the highest yield on land producing less than 50 bushels per acre. The data from the northern fields show that the best yields were taken from the plats with three kernels per hill, and also from those on which the hills were practically 36 inches apart each way. In the central part of the State the highest average yield from land producing over 50 bushels per acre was secured by planting two kernels per hill at a distance of 33 by 36 inches. Almost the same yield was obtained where the hills were planted 39.6 inches apart each way with three kernels per hill. On land yielding less than 50 bushels per acre practically the highest average yield was secured where two kernels were planted per hill in rows 36 inches apart in each direction.

In summarizing the results it is advised that on all ordinary corn-belt land of the northern part of Illinois the hills be planted not more than 36 inches apart and with at least three kernels per hill, and that in central Illinois, on the common brown silt loam prairie lands, sufficiently productive to produce over 50 bushels per acre, corn be checked 39.6 inches apart and three kernels planted per hill, while on the common prairie land not generally producing 50 bushels per acre,

as, for instance, average corn-belt land, the hills should be 36 inches apart and only two kernels planted per hill.

THE BURSTING OF CARNATIONS.[a]

Carnation growers are familiar with the often serious tendency of the blooms to split the calyx, or burst, as the trouble is commonly called. The immediate cause of bursting appears to be a too rapid or premature petal development before the bud as a whole has made its growth. It is very prevalent in some varieties. F. Dorner, sr.,[b] says: "There are numerous varieties which habitually split the calyx and are worthless. There are also some which under certain circumstances split what appears to be the strongest kind of a calyx, while, on the other hand, some large flowers are held intact by an apparently weak one." It goes without saying that worthless varieties should be abandoned. Growers have learned from experience, however, that unfavorable cultural conditions may cause serious cases of bursting among varieties which are profitable bloomers when properly grown.

Although there are well-established methods for the general culture of greenhouse carnations, certain varieties differ sufficiently in their requirements to call for specific treatment in some form or other. Such specific treatment must be determined from cultural experience. On the other hand, the fragmentary literature on the subject of bursting would seem to warrant the general statement that plants which have been hardened off or grown slowly, whether through a low temperature, dry soil conditions, or a lack of fertilizer, are very apt to produce bursted blooms when suddenly overstimulated either by too much heat, moisture, or plant food, or through some unfavorable combination of these conditions.

The Maryland Station reports an investigation along this line, in which it appears that a location unfavorable for uniform temperature and moisture conditions will aggravate the bursting tendency. Such a location is found in the rear part of a side bench, when there is no space between the bench and the wall.

> It was noticed that the row of carnations located near the glass of the side benches produced more bursted flowers than did the other rows on the benches. During the winters of 1904–5 and 1905–6, a record was kept of the good flowers and the bursted flowers on the different rows. * * * The row nearest the glass produced 21 per cent of bursted flowers, while only one other row gave as high as 7 per cent.
>
> * * * It was found almost impossible to secure uniform conditions near the glass, the soil drying out badly, although receiving a normal supply of water. Many growers find less trouble with this bursting of the calyx when the benches are so placed as to allow a walk between them and the side walls.

[a] Compiled from Maryland Sta. Bul. 127; Rhode Island Sta. Bul. 128.

[b] Amer. Breeders' Assoc. Proc., 3 (1907), pp. 67–71.

The walk next to the wall provides for free air circulation around the bench, thus lessening the danger of excessive sun heat and, in some cases, of excessive bottom heat as well. Side ventilators can be used with greater safety and the bench will be given closer inspection.

The Rhode Island Station recently reported an experiment in which the principal object was to determine what influence, if any, nitrogen has upon the tendency of the calyx to split open. Three varieties were used in the work in order to determine whether the same results would be secured regardless of varietal tendencies. The varieties were Hector, Wm. Scott, and Lizzie McGowan. "A long, narrow bench was divided into two equal beds, each 26 inches wide by 8 feet 9 inches long. Like amounts of subsoil were then placed in each. * * * The manurial treatment was identical, excepting that on the east plat no nitrogen was applied, while on the west plat nitrogen in a nitrate, an ammonium salt, and inorganic matter was applied." The experiment was carried on for two years.

With nitrogen in the manures a great advantage resulted with the variety Hector, both in salable blossoms and the number of those with a perfect calyx.

With the variety Lizzie McGowan, the results were in favor of the use of the nitrogen, especially the first year of the trial, but were far less marked than with the Hector.

In the case of the variety Wm. Scott, the results were better where nitrogen was omitted than where it was employed.

The results show that when the house is maintained at the same temperature, generous manuring with nitrogen may increase the total number of perfect blossoms of one variety of carnations and lessen the number of another variety.

Whether the same differences, as a result of the manuring, would appear if the most favorable temperature for each variety were maintained in the house is yet to be determined.

It appears probable that the character of the manures, as well as the degree of forcing, tends to affect the splitting of the calyx.

C. W. Ward,[a] in the following words, points out how the carnation breeder may lessen the bursting tendency: "In selecting a seedling for the second year's trial, be sure of a firm, large, well-formed calyx, for if you fail to select good firm calyces a crop of 'bursters' may be your reward."

The commercial grower likewise can reduce the trouble by studying the habits and requirements of the individual variety, and by so regulating the various conditions in the greenhouse as to prevent sudden fluctuations in the rate of growth. Although it is doubtful whether the bursting of the blooms can be entirely eliminated, further investigations along this line may lead to methods of control which will reduce the trouble to a minimum.

[a] The American Carnation: How to Grow It, C. W. Ward, p. 204.

STREET TREES; CARE AND PRESERVATION.[a]

The increasing number of State and municipal laws which are being enacted for the care and preservation of street trees is ample evidence of a growing public interest in this matter. It should be borne in mind, however, that the shade-tree laws of any community can not be thoroughly effective unless the public is familiarized with these laws as well as with the important sources of injury to trees. Adjacent property owners in particular should be equipped with this knowledge, since prompt action on their part will often prevent forms of mistreatment or injury which may temporarily escape the notice of the tree warden.

The sources of injury to street trees are undoubtedly more numerous in the cities and large towns than along village streets and country roads. Nevertheless, the increasing number of overhead electric wires in the latter thoroughfares is resulting in much serious damage. This source of injury and also the effect of illuminating gas escaping into the soil has been discussed in previous bulletins of this series.[b]

In a recent bulletin of the New York Cornell Station, A. D. Taylor discusses many ways in which trees are injured through ignorance and neglect; as, for example, in the course of construction work, by piling building materials against them, in moving buildings, in attaching guy wires, and in grading streets.

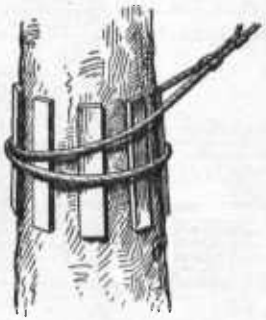

FIG. 1.—The correct method of attaching a guy wire.

The piling of brick, lumber, and stone slabs close against the trunk may cause injuries which allow decay to enter at that point. Tying guy wires for the purpose of supporting derricks or telephone poles is a common practice, and will cause no injury to the tree if properly done. It is done so often without protecting the tree, however, that serious injury results. The correct method of attaching a wire of this kind to a tree is to place a number of small strips of board against the trunk, parallel to its axis, and then bring the pressure of the wires to bear directly on these (see fig. 1). If the trunk is forked the wire may be carried between the branches near the crotch and attached to a crosspiece, which, being placed transversely to the axis of the two branches, brings the pressure to bear on each, and no mechanical injury is caused to the tree. When the pole to be guyed brings little pressure to bear on the wire, a lag screw may be placed in the side of the tree and the guy wires fastened thereto. In any case the growth of the tree may continue without the common danger of its being girdled. * * *

[a] Compiled from New York Cornell Sta. Bul. 256. See also Massachusetts Sta. Bul. 125.

[b] U. S. Dept. Agr., Farmers' Buls. 210, p. 20; 316, p. 12.

The cutting away of branches in order to make an unobstructed road for the moving of a building along a highway is frequently seen. * * * Adjacent property owners * * * should obtain from the court an injunction, by means of which the work could be delayed until a judgment may be given.

The regrading, widening, and general improvement of highways cause annually the unnecessary loss of many beautiful park and avenue trees. Often, with no intelligent person to direct this part of the work, large numbers of trees are removed which could well have remained. Because a street has been widened, and a valuable tree stands where it may inconvenience traffic a little in the new arrangement, is not sufficient justification for its removal. In such instances, the situation should be carefully investigated and the evidence on both sides considered. The sentiments associated with old landmarks are often too strong to be considered as trifling. The tree to be removed may be so valuable a factor in the æsthetic life of the community that the inconvenience of going around it will never be great enough to warrant its removal.

In regrading lawn areas it sometimes becomes necessary to make deep cuts or large fills about the bases of trees, which would cause their death were they not properly protected. In general, when cuts or fills average between 1 foot and 3 feet in depth, the tree may be preserved by leaving a mound for cuts; or, in the case of fills by building a well around the trunk to keep the soil from the bark (see fig. 2). Trees injured as a result of removing soil from the base die because the roots dry out, while those injured from fills die because the soil packed around the trunk suffocates that part of the tree, kills the small feed roots, and rots the bark. A few of the very hardy species of trees will survive such conditions of fill, while others are very susceptible to its ill effects.

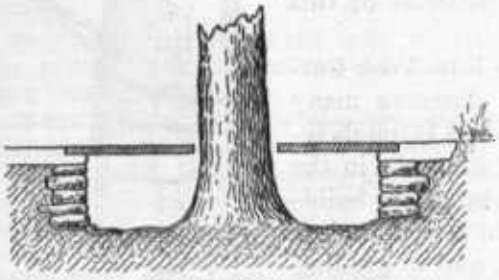

FIG. 2.—"Well" around trees.

Trees with brittle wood, as well as broad-headed, vase-formed trees, are often seriously injured by wind and ice storms. "Protection can be given best only by a correct selection of deciduous trees, and by keeping from conifers the heavy loads of snow, which break the branches during the winter." All dead wood should be removed, both for the sake of appearance and because it is a source of danger to the public.

Trees are often injured, and sometimes killed, from the effects of freezing.

The greatest danger from freezing lies not in the fact that many trees in a normal condition of growth are killed back, but rather that improper pruning and unprotected wounds cause cavities to appear on the trunk and larger branches; these fill with water during the summer months, and during the winter months the ice formed in them splits seams up and down these parts of a tree (see fig. 3). These seams or cracks, small at first, close during the first summer, but during the succeeding winter are again subjected to freezing

processes, which open permanent cracks that continue to increase in size from year to year, and to give free access to the many disintegrating processes of nature. The only protection for such a tree is to employ some one who is fully informed on the methods of tree surgery to seal the cavity, and thus prevent further decay or freezing.

In selecting a species for planting in any particular region it is best not to accept the advice of a journeyman nurseryman, but rather to seek some one who is acquainted with the climatic conditions of the region and who knows the degree of hardiness that a species should possess to be grown successfully.

Other sources of injury discussed in the bulletin referred to are horse bites, grazing by wagon wheels, starving of root systems, smoke and gas from factories, overcrowding by improper spacing, and girdling by wire labels. Trees can be readily protected from horses and vehicles by using some sort of guard. One made of wire netting, as illustrated in figure 4, is both neat and effective. There are many good ready-made guards on the market.

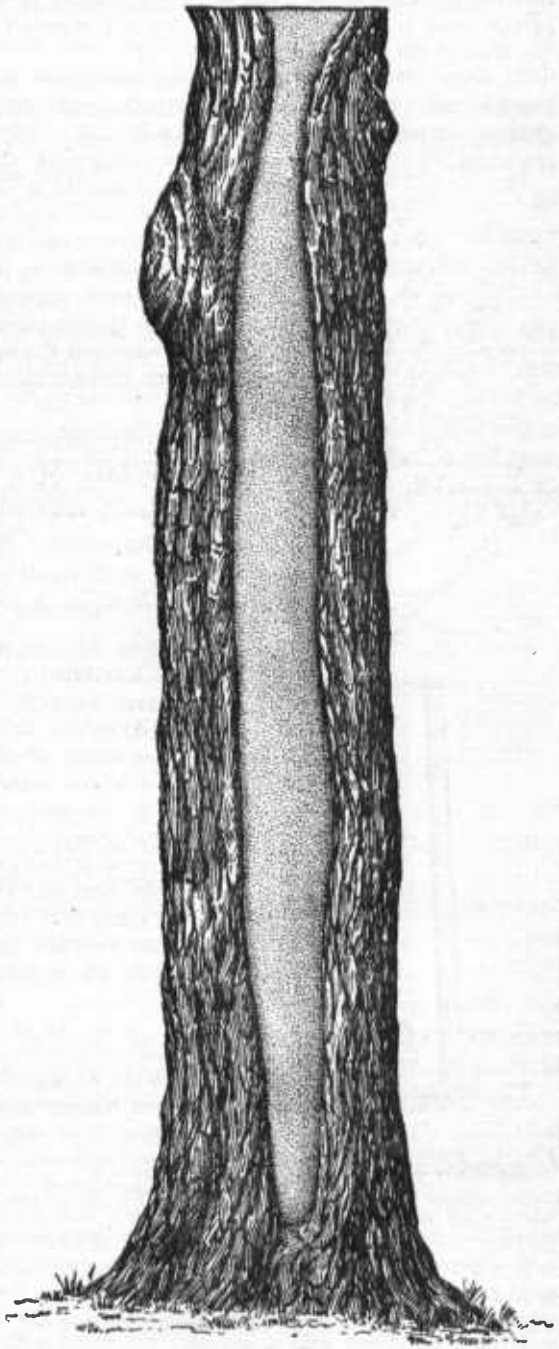

FIG. 3.—Preservation by means of cement filling.

These guards should be removed as soon as the trees attain the size when binding is likely to take place. Such binding is likely to force the upper part of the trunk to grow out over the top of the guard and so lessen the strength of the tree, if not completely to girdle it.

In some cities ordinances provide penalties for the hitching of horses to trees on the highway, and such ordinances should be enforced. * * * Each community must expect a certain amount of accidental injury from this source; but no community should permit the custom to prevail of making a hitching post of a tree standing in front of a residence.

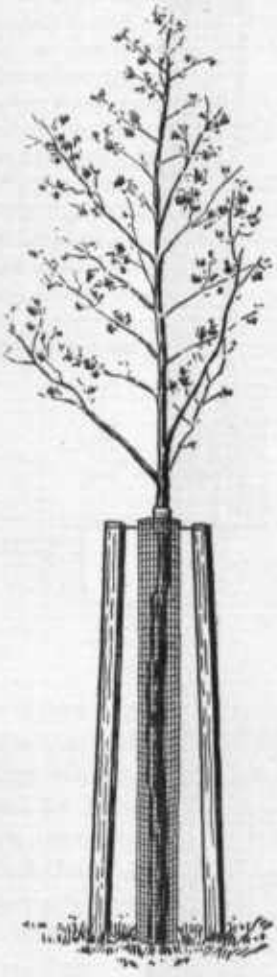

FIG. 4.—Staking and protecting newly planted trees.

Trees that show injury from the above causes, and especially those that have areas of the trunk devoid of bark, should be given attention without delay, the ragged edges of the bark being cut to a smooth edge and the entire area covered with paint or tar to protect the wood during the process of healing.

The soil along the streets and highways is frequently of a sterile nature. This is particularly true where big fills or deep cuts have been made. In some cases the soils are too wet and in others they are too dry for favorable root development.

The trees on city streets suffer most often because of a naturally poor soil and a lack of sufficient water supply. City streets that are macadamized, paved, or concreted present a surface layer that shuts off almost completely the natural means by which water may reach the roots, and directs all of the surface drainage into catch-basins and sewers. Thus, trees on such streets are subjected to the extreme of adverse conditions, and their natural vitality and soil adaptation must be such that they can withstand the abnormal strain on their vitality or they are certain to meet with an unnatural and premature death. Only a very small percentage of the trees used for city work are of the species best adapted to withstand the conditions.

A scarcity of water from the surface, together with an abundant supply from the subsoil, fosters the production of deep-seated roots, which are one of the most valuable assets of a good shade tree. On the other hand, a thoroughly water-clogged soil admits no air circulation and increases the tendency to the development of surface roots, which are killed during periods of drought; it also provides avenues for root diseases, and finally leads to the death of the tree. Poor soils bring about the condition often known as "stag-head," the symptoms of which are a stunted and sickly appearance of the tree, the presence of slender and weak branches, and a sparsely scattered yellow foliage. The remedy for such a condition depends on its stage of development when detected. In its

early stages the tree may be rejuvenated by digging out a quantity of the poor soil and replacing with good loam; if the specimen shows too great a degree of weakness it had better be substitued by a younger, vigorous specimen.

Along city streets, where conditions are so often unfavorable to tree growth, the holes for newly planted trees should be filled with loamy soil, and they should be large enough to provide for future root development. A bed 4 feet wide by 8 feet long and 2 feet deep is none too large. In streets which are often congested with people it may not be feasible to leave such a large open space for each tree. In such cases an iron grating, as shown in figure 5, can be placed over the area that is not paved. This will prevent the soil from becoming impenetrable to surface water.

In large manufacturing centers smoke and atmospheric gases are often present in sufficient quantities to seriously injure or even kill the surrounding trees. "The functions of the leaves are retarded in two ways: First, the breathing pores, or stomata, become choked with the soot; and, second, many gases in themselves may be poisonous, even when diluted with the atmosphere." Since most trees are subject to the effects of smoke and gas, it is highly advisable that "trees should be selected on the basis of results secured with similar species in other cities and towns under similar conditions." Municipal authorities may be able to prevent the excessive production of smoke and gases, but it is very probable that they will always be present in considerable quantities wherever factory interests are large.

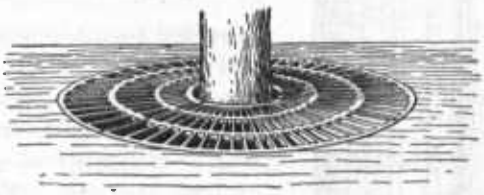

FIG. 5.—A grating to cover "well."

Overcrowding of street trees can be prevented if the trees are properly spaced when planted. Information relative to the space required for the normal development of our shade-tree species is not difficult to obtain. In situations where there are no shade trees, there is a tendency to plant close, in order to secure shade quickly. There is danger in the close planting of young trees, however, due to "the necessity of their removal at a subsequent date, when only a person possessing the courage of his convictions will take out the trees that should be sacrificed. * * * Every town and city possesses trees that are suffering from this evil of overcrowding. Each community should designate some intelligent person to direct the work of caring for the pruning of such trees, who, despite false sentiment, will accomplish the work."

Trees that have been seriously girdled through failure to remove the label wires, or from other causes, can often be saved by bridge-

grafting the wounded part. "This is done by trimming smooth the edges of the girdled part and inserting scions of the same species under the bark in such a way that the wound is bridged over (see fig. 6). These scions, being placed very close together around the stem, become united at the ends with the old trunk and serve to conduct the elaborated food material down to the lower parts of the tree. During the period of uniting the scions are covered with grafting wax much as is an ordinary graft, and no shoots developing from buds on the scions are permitted to grow. In time, as the tree develops, the wounded part is entirely healed."

Mr. Taylor calls attention to two forms of tree butchery or improper pruning: "The butchery that is practiced when wires are first strung, and later at intervals to prevent the subsequent growths from coming in contact with the wires," and the butchery by men "who, through ignorance of the fundamental principles which underlie the operations they would perform, and yet with the best of intentions, have ruined whole avenues of valuable trees by the very process which was intended to prolong the lives of these trees and to add to their beauty and usefulness." Such careless or ignorant treatment results in many ugly wounds and projecting stubs of dead branches which, if neglected, may lead to the development of large cavities. Tree owners in general should employ only well-recommended persons to prune their trees and to treat existing wounds. The treatment of such wounds has, in recent years, become known as "tree surgery;"

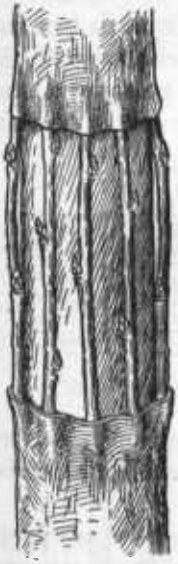

FIG. 6.—Bridge grafting, for the preservation of girdled trees.

Systematic pruning and tree surgery are very closely related. Tree surgery includes the intelligent protection of all mechanical injuries and cavities. Pruning requires a previous intimate knowledge of the habits of growth of trees; surgery, on the other hand, requires, in addition, a knowledge of the best methods for making cavities air-tight and preventing decay. The filling of cavities in trees has not been practiced sufficiently long to warrant making a definite statement as to the permanent success or failure of the operation; the work is still in an experimental stage. The caring for cavities in trees must be urged as the only means of preserving affected specimens, and the preservation of many noble specimens has been at least temporarily assured through the efforts of those practicing this kind of work.

The subject of pruning as well as the protection of wounds and the treatment of hollow trunks is discussed in a previous Farmers' Bulletin[a] and will not be further considered at this time. The reader

[a] U. S. Dept. Agr., Farmers' Bul. 181.

is also referred to bulletins dealing with insect enemies of trees,[a] tree planting on rural grounds,[b] and beautifying the home grounds.[c]

The literature on the subject of shade-tree protection will be of the most value when it serves as a means for preventing rather than curing injuries. By far the greater part of the injuries from which trees suffer can be prevented. When once inflicted, however, it is often very difficult or even impossible to remedy them adequately. In many cases the existing laws are quite sufficient to give all the protection desired. The people should know the laws, and have interest enough in the preservation of trees to insist that they shall be obeyed. The most successful plan for cities and large towns seems to be to place the care of street trees directly in charge of a commission or park board empowered by special ordinances to carry out its plans. This gives opportunity for a systematic development of tree culture throughout the entire community and makes it possible to employ experts to direct the work. Similar arrangements can also be adopted in smaller communities with such changes as are necessary to suit local conditions.

SPRAYING FOR WEEDS.[d]

The eradication of weeds by other than cultural methods has been a subject of study at a number of the agricultural experiment stations and elsewhere. This has resulted in the discovery that various chemicals through their corrosive or other action will destroy many kinds of weeds. As long ago as 1895 it was shown by the Vermont Station that the orange hawkweed, a pest in lawns and pastures, could be controlled by sowing salt over the lawns at the rate of about 3,000 pounds per acre without injury to the grass. Lime, salt, arsenite of soda, gasoline, kerosene, crude carbolic acid, and copper sulphate have all been recommended for destroying weeds in drives, walks, tennis courts, and other places where it is desired to keep down all plant growth. Where cultivated plants are grown, thorough tillage can be relied upon to keep down weeds, but the serious problem of eradicating weeds in grain fields, pastures, and large lawns is the one to which present consideration is given. For this purpose, whatever materials are used they must not be seriously injurious to

[a] U. S. Dept. Agr., Farmers' Bul. 99; 296, p. 19.

[b] U. S. Dept. Agr., Farmers' Bul. 134.

[c] U. S. Dept. Agr., Farmers' Bul. 185.

[d] Compiled from Minnesota Sta. Bul. 95; North Dakota Sta. Bul. 80; Rpt. 1907, p. 76; Rhode Island Sta. Rpt. 1906, p. 159; Vermont Sta. Rpt. 1895, p. 115; Wisconsin Sta. Rpt. 1906, p. 259. See also U. S. Dept. Agr., Farmers' Buls. 124, p. 19, and 296, p. 10.

the grain crop or the grass, yet they must be sufficiently destructive of weeds to make their use economically practicable.

In parts of the grain-producing States of the Northwest, wild mustard, or charlock, and wild radish have become especially troublesome, the wild mustard particularly so. This weed is very common in wheat, oat, flax, and other grain fields from Wisconsin to the Dakotas and adjoining States, and it not only crowds out more valuable plants, but it may become positively injurious through its abundance. Like many others of our most troublesome species, the wild mustard is of European origin, and for many years spraying with corrosive chemicals has been practiced in the warfare against the pest in Europe. Copper sulphate (blue vitriol) and iron sulphate (green vitriol or copperas) are the substances most used. Both are efficient in destroying the wild mustard, the principal difference being in their relative cost. The blue vitriol costs more per pound, but does not require as strong a solution as is necessary of iron sulphate or copperas. There is now on the market a granular form of iron sulphate that can be secured for about $10 or $12 per ton, or even less when bought in large quantities. This is applied in the form of a solution, about 100 pounds of copperas being dissolved in 50 gallons of water. At this rate it makes about a 20 per cent solution, and 50 gallons is sufficient for spraying 1 acre, if properly applied. For its application a good spraying machine is required, and if a considerable area is to be treated one of the better power sprayers that deliver the solution with considerable force should be used. For small areas, hand or knapsack sprayers may be employed.

The directions given by the Wisconsin Station for spraying oat fields with a solution of iron sulphate for the eradication of wild mustard will apply to the treatment of almost any grain or grass field.

The spraying should be done on a calm, bright day, after the dew has disappeared, as the work is more effective if the solution is put on in the warm sunlight. When rain follows the spraying within a few hours the extermination of the mustard will not be complete.

The grain fields should be sprayed when the mustard plants are in the third leaf, or before the plants are in blossom, in order to have the spray do the most effective work. The day following the spraying the tips of the blades of grain may be somewhat blackened, but no detrimental effects can be noticed, either to the crop or grasses seeded with it, two weeks after spraying.

Daisies, cocklebur, bindweed, ragweed, chicory, sheep sorrel, yellow dock, wild lettuce, and many other weeds were partially or wholly eradicated from the fields where tests were made for the extermination of mustard.

In addition to the charlock, or wild mustard, and those mentioned above, other weeds are destroyed by the spray without injury to the

crops, among them, according to the reports from the North Dakota Station, being the very troublesome Canada thistle.

The explanation of the action of the chemicals seems to be about as follows: The chemical, which is corrosive, attacks the young and tender tissues of the rapidly growing weeds, causing their destruction, while there is little if any injury to the grain crop, particularly if it is a winter grain or one that was sown early in the spring, so that the crop has gained considerable growth before the spraying.

Investigations at the North Dakota Station with chemical means for the control of weed pests have shown that in addition to weeds in fields, such persistent weeds as dandelions may be eradicated in lawns, parks, and meadows by thorough spraying with the iron sulphate solution without any injury to the lawn or pasture grass. In the region about Fargo, where the experiments were conducted, spraying once a month or every six weeks throughout the year was found to keep the dandelion in check. For spraying lawns the application should be made a few days after the grass has been cut, with a solution of about 2 pounds of iron sulphate to a gallon of water. The spray should be forcibly applied, not merely sprinkled over the weeds, on a bright sunshiny day, and the lawn should not be mown for two or three days after the spraying. Heavy rains soon after the spraying will destroy the weed-killing power of the solution. Wherever chemicals are used for weed eradication on lawns it will be found advisable to scatter grass seed over the lawn each spring and fall.

In many regions alfalfa and clover fields are infested with dodder, a parasitic plant that may be recognized by its yellow, thread-like stems which entwine the plants. Hiltner[a] says that dodder may be destroyed by spraying infested areas with an 18 to 20 per cent solution of iron sulphate. The immediate effect of the chemical is to blacken the clover or alfalfa, but after a short time the crop recovers and is as vigorous as ever, while the dodder has been completely destroyed. In South Africa,[b] spraying alfalfa with sodium arsenite at the rate of one-half pound to 5 gallons of water when well applied was found to destroy dodder with little injury to the alfalfa.

MARKET CLASSES AND GRADES OF SHEEP.[c]

A recent bulletin of the Illinois Station, by W. C. Coffey, defines and illustrates the various classes and grades of sheep recognized on the Chicago and other large markets. The information is intended

[a] Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 6 (1908), No. 4, p. 40.

[b] Agr. Jour. Cape Good Hope, 32 (1908), No. 2, p. 152.

[c] Compiled from Illinois Sta. Bul. 129. For classification of other farm animals see U. S. Dept. Agr., Farmers' Buls. 222, p. 24; 334, p. 22.

to aid those engaged in growing and handling sheep to understand and apply the market reports.

The grower or feeder offering sheep for sale often forms a very imperfect estimate of their market value, and chiefly because his contact with the open market has not been sufficient to familiarize him with the factors embodied by the various terms in market reports. * * * Because his judgment as to the true market worth of his sheep is uncertain, the owner may suffer a financial loss in dealing with a local buyer by selling under the market value or by missing a sale by asking too much for them. If, at the time of sale, the owner could definitely determine the value of his sheep, he would experience less difficulty in coming to an early understanding with the local buyer, or in case he shipped them direct to the open market, the chances for disappointment and dissatisfaction would be greatly reduced. While it is the privilege of a few to visit the markets often and there learn the requirements and the demands for the different grades in the various classes, the great majority of sheep owners, and many feeders, must depend largely upon the market reports for such information, and the value of these reports to the man who proposes to buy or sell sheep is determined by the extent to which he can apply them to his particular purchase or sale.

MUTTON SHEEP.

Under this head are classed "all sheep and lambs sent to market for slaughter, no matter what the condition, age, or weight," including both native and western sheep.

Native sheep are those produced, ordinarily in small flocks, on the farms of the Central, Southern, and Eastern States. Western sheep are those produced, usually in large bands, on the ranges of the Western States. As a rule, western sheep have enough Merino blood to make them markedly different in appearance from natives which are mostly from mutton-bred parents. But even were they identical in breeding, buyers and salesmen on the market could easily distinguish between them because of differences resulting from the way in which they are fed and managed. On markets where both native and western sheep are received, the daily reports nearly always distinguish between them, but in this bulletin no attempt is made to classify them separately where they are both put to the same use. Hence both native and western sheep are placed in the mutton and in the breeding classes, but only western sheep are placed in the feeder class. While thin natives are often bought up in the country and successfully fed, those that reach the market in low condition do not sell as feeders because they are usually infested with internal parasites, thus making it difficult and in many instances impossible to fatten them.

It is stated that a common practice is "to prefix the word 'fed' before a certain class and grade to distinguish grain from grass-fattened sheep. The term is used for a short time in the autumn and in the spring when both grain and grass fattened sheep are coming to market."

Lambs.—Of the various subclasses of mutton sheep "the one known as 'lambs' is by far the most important, due to the fact that the producer can most profitably market his sheep as lambs and also that lamb is preferred to mutton by the consumer. * * *

It is estimated by traders upon the Chicago market that at least 80 per cent of the sheep received at that place are lambs. * * *

At from 12 to 14 months of age lambs pass into the yearling and ewe classes. But it is the degree of maturity the young animal has attained rather than a set, definite age which determines whether or not it belongs to the lamb class. Native lambs usually reach maturity at an earlier age than western lambs, because they receive a greater abundance of feed, and they are generally free from Merino blood. * * *

The most important factors in determining the grade to which lambs belong are form, quality, condition, and weight, and the grades recognized on the market are: Prime, choice, good, medium, common, or culls.

It is understood that when lambs are graded as prime they are the very best of the class that may be generally expected on the market. * * *

Before a lamb is graded as prime it is determined by sight and touch that it possesses the form, quality, condition, and weight demanded by the dealer in high-class mutton. The butcher demands the form that shows the most development in the loin, back, and leg of mutton. He demands development in these regions because they are the parts from which the high-priced cuts are secured. The animal should show a great deal of depth and breadth and no tendency to be paunchy, because paunchiness adds to the percentage of waste in slaughtering. The prime lamb should present a general fullness and smoothness of outline, both of which indicate thickness and evenness of flesh. There should be an absence of roughness because the waste in the dressing of the rough, ungainly lamb is large in proportion to the carcass, and, furthermore, the appearance of the carcass of such a lamb fails in attractiveness when placed on exhibition in the market. It is generally conceded that form is enhanced if the body is supported by short legs. However, many prime lambs have only moderately short legs. Very long legs detract from the dressed yield and from the appearance of the carcass when displayed, and on this account lambs that are decidedly upstanding do not grade as prime. * * *

General quality is indicated by a medium sized, clean-cut head, ears of fine texture, and fine but strong bone, a light pelt, and full, well-rounded outlines. All these suggest a freedom from that coarseness which adds to the waste in dressing, and the unattractiveness which works against the value of the carcass. Of the items of general quality enumerated, lightness of pelt is the most essential. By pelt is meant the skin and wool combined. To secure a pelt of light weight, the skin should be comparatively thin and free from folds or wrinkles, and the wool should not be very dense or oily. * * *

"The weight of a pelt may be appreciably influenced by the condition of the wool with reference to foreign material and moisture in it," the presence of large amounts of these greatly reducing the price that will be offered.

Occasionally the general quality of lambs may be developed to such a marked degree that they will sell as prime, even though they be somewhat deficient in form. A notable example is the fat Mexican lamb. From the standpoint of form the Mexicans are not especially attractive, since they are upstanding and have narrow bodies and long necks, but they are unequaled in the fineness of their features and their lightness of pelt. Without their high development of general quality they would not receive favorable consideration from buyers, but because of it, when fat, they top the market.

The terms "quality" and "condition" are frequently used interchangeably on the market, and chiefly because the quality of flesh is largely dependent upon

condition. By condition is meant the degree of fatness of a lamb. Tho reasons why a lamb should be fat are: (*a*) Other things being equal, thero will not be as high a percentage of offal as in the half fat or the thin lamb; (*b*) the fat adds to the attractiveness of the carcass, and thus makes it more inviting to tho purchaser; (*c*) the comparatively fat carcass loses less in weight in the process of "cooling out" in the refrigerator and also in cooking; (*d*) some fat on the outside of the lean meat and a considerable amount deposited through it adds to its palatability by making it more juicy and of better flavor.

Desirable quality of flesh is indicated by firmness along the back, at the loins, over the sides, and at tho leg of mutton. * * * While the flesh should have that firmness which would impress an inexperienced man as being hard, it should havo just enough springiness to yield slightly to the touch. * * * Tho development of fat essential to the prime lamb is indicated by a thick dock, a full, mellow purse, thickness and smoothness on the back and over the ribs, fullness at the neck and flanks, and a plump, well-filled breast.

It is impossible to tell with exactness, by merely looking at it, the condition of a lamb in the wool, and hence it is necessary to judge condition by placing the hands on the animal. Experts rely upon placing the hand but once, for example, by spreading the hand so that the back and ribs will bo touched by one stroke, or by grasping the loin, or by getting the thickness and fullness of the dock, but none risk their judgment upon sight alone. A great deal is determined by the stroke that touches the back and ribs because it not only reveals the condition as evidenced by the degree of smoothness present, but also the amount and quality of the flesh by the thickness and firmness of it. This stroke also aids in determining the kind of pelt a lamb may have with respect to thickness of skin, density of wool, and foreign material in it.

Weight is a factor that varies somewhat with the different seasons in the year, but in general the lamb of prime quality and condition and weighing 80 pounds sells at the highest price. When spring lambs first appear on the market, they weigh little more than 60 pounds, but if they have the quality and finish, they easily command top prices.

The requirements of form, quality, and condition in case of prime lambs apply also in case of prime yearlings, prime wethers, and prime ewes.

To grado as choice, lambs can not fall below tho requirements for prime lambs to any marked degree. They must have the form, quality, and condition that make them desirable as mutton of a high class. They usually fail to sell as prime lambs because they are not quite up to the standard in quality, condition, or weight. While lambs frequently fall to grade higher than choice because of their quality or their weight, a lack in condition is most often the retarding factor. This is the grade that includes by far the greater number of the better offerings upon the Chicago market. * * *

Upon the market, buyers and salesmen often prefer to speak of a band of lambs as being "good to choice" rather than using either of the terms separately to describe them. This, doubtless, is partly due to the unevenness in bands of lambs, which suggests two grades rather than one. If there is a pronounced unevenness in an offering, that alone is sufficient to prevent them grading better than good. But the individual lamb must be noticeably deficient in form, quality, condition, or weight, or slightly deficient in each, thus making a lower grade through a combination of deficiencies.

Lambs of the medium grade lack to a large extent the condition and quality necessary in the prime lamb.

It is in this grade more than any discussed above that faulty form is apparent. Long, loosely coupled bodies, with little spring of rib, and rough outlines are frequently seen. Because they are coarse, underfinished, and often paunchy, they do not dress a high percentage, and what they do produce is without sufficient fat to meet favor with dealers who handle high-class mutton. Only the coarser, heavier pelted western lambs are found in this grade, as the smoother, tidier range lambs in underfinished condition are sold to go to the country as feeders. Many native lambs, however, come in this grade, because those appearing on the market in low condition or those on the coarse "bucky" order are not sought as feeders.

Lambs are in the common or cull grade chiefly because they are very far below that condition of flesh that would make them desirable for mutton.

Coarse, ill-shaped lambs commonly belong to this grade, but not unless they are noticeably lacking in quality of flesh and amount of fat. Offerings in this grade are very light in weight, the range, with the one exception (coarse, "bucky" natives), being from 30 to 50 pounds.

As practically all native lambs appearing in the market go to slaughter while thinner western lambs are sent to the country as feeders, natives form the bulk of the common or cull lambs.

Under present methods of sheep husbandry, it is impossible to send all native lambs to market in desirable condition, because growers of natives have not yet learned how to keep them free from infestation by internal parasites, and when they are infested to any great extent they do not take on fat.

In both the common and medium grades are frequently seen what are known as coarse, "bucky" native lambs. These are the result of careless shepherding on the part of growers. If lambs are left entire they rapidly become coarse when their sex instinct develops, and because of this coarseness and the loss of fat resulting from a great amount of fretful activity, they are undesirable as mutton. * * * Growers of natives would save much to themselves annually if they would make it a practice to castrate their ram lambs a few days after they are born. These coarse, "bucky" lambs are heavier than the bulk of common lambs, as they sometimes weigh as much as 100 pounds.

The term "cull" is common parlance in sheep market circles, but it has a double meaning. One applies to the lowest grade under a given class, and it is in this sense that the writer uses the term; the other, to the number a buyer may have the privilege to reject when purchasing a band of lambs or sheep at a given price. Therefore, in defining the lowest grade of lambs, the term "common" is less confusing than the term "cull."

Yearlings.—Yearlings of a certain grade are used as substitutes for lambs in the meat trade.

The ability of the animal to substitute in this way depends upon its weight, quality, condition, and immaturity. An index greatly depended upon for identifying the carcass of a young sheep, or lamb, is what is known as the "break joint," which is found immediately above the pastern point. The leg easily severs at the "break joint," leaving a reddish, porous, indented surface, over

which there is a slight, viscidlike secretion easily noticeable to the touch. The presence of this joint in the live animal is best determined by feeling just above the pastern joint for a bonylike prominence, which is a true indication of it. It disappears when the sheep becomes mature, and a sheep that does not have it can not class as a yearling. The yearling class is composed exclusively of wethers, because the "break joint" disappears in ewes at about the time they pass out of the lamb class. Lambs born the year previous to the time they appear on the market pass out of the lamb class about July 1, and from that time the wethers are called "yearlings" until they are too far toward maturity to "break," as the salesmen and buyers familiarly refer to the "break joint."

Yearlings are commonly designated upon the market as "lights" and "heavies." These terms, as they would indicate, refer to weights. Thus we frequently hear the phrases "prime lights" and "prime heavies," by which is meant the quality and condition of animals coming within certain limits of weight rather than their desirability as mutton. And, hence, it is felt that "lights" and "heavies" are not strictly logical terms upon which to base gradations in this class.

Since yearlings are used to take the place of lambs, the nearer they approach the quality, condition, and weight of prime lambs the more satisfactorily will they accomplish the purpose for which they are intended. Any great departure in any of the above characteristics as applied to prime lambs will seriously affect the desirability of yearlings, and if they are low in condition they are practically out of consideration as such.

The grades of yearlings are prime, choice, and good.

Yearlings, to grade as prime, must be highly developed in form, quality, and condition, and of a light, handy weight, which ranges from 70 to 90 pounds. The form of the prime yearling embodies symmetry, compactness, roundness, and smoothness, with no suggestion of uneven lines or prominent parts. Unless such a form is secured, the carcass will appear too great in size to look like a lamb. In general quality the requirements are fine, clean-cut features and a pelt of light weight. As with prime lambs, so with yearlings, a high dressed percentage is demanded, and this is not possible with the animal having very coarse features and a heavy pelt.

The most important considerations in placing a yearling in the prime grade are quality of flesh and the amount of fat it carries. Slight concessions may be made to a lack in general quality and form, but none to a lack in fat. Unless fat the yearling is unsatisfactory, hence buyers discriminate sharply against those not showing a high finish.

Since it is difficult to secure the most desirable form, quality, condition, and weight combined in one animal, choice yearlings outnumber those of the prime grade. Any noticeable departure from what is considered prime in any of the above characteristics is sufficient to place a yearling in the choice grade. During the winter season, when the offerings of sheep are almost wholly grain fattened, the greater number of yearlings are in prime condition; but at all times there are offerings that are not of the most desirable form, quality, and weight. * * * Those of more than 90 pounds weight, although they may be in prime condition, rarely grade better than choice. * * * There can not be a great difference between the condition of prime and choice yearlings, and, in fact, the total difference between them is not great.

Undesirable quality, weight, or condition, or a combination of deficiencies in any two or all three of the above, will, if readily apparent, place a yearling in

the good grade. With a few scattered exceptions this is the lowest grade of yearlings offered as mutton. Yearlings of 110 pounds and upward rarely grade better than good, even though they be prime in every other respect. Ill form, general coarseness, and undue weight of pelt are all serious objections, and those having such defects are nearly always placed in this grade. A rather frequent combination, placing yearlings in the good grade, is underfinished condition and undesirable quality. If yearlings are assigned to this grade solely because of a want of fat, they are almost on the border line between the mutton and the feeder class, and are not much wanted by either packers or feeder buyers.

Wethers.—Mature castrated males compose this subclass.

Since comparatively few native wethers appear upon the market this class is looked upon as chiefly a western product. * * *

The same conformation, quality, and condition are demanded in prime wethers that have already been noted as characteristic of prime yearlings. The most desirable weights range from 95 to 110 pounds, and are popularly known as "light handy weights." However, wethers weighing 140 pounds and upward frequently grade as prime if their heavy weight is accompanied by desirable conformation, quality, and condition.

The choice wether is usually slightly short of prime in form, quality, and condition. Quality in this instance applies more particularly to lightness of pelt and to freedom from paunchiness than to coarseness of features. Wethers of this grade must also come under the light, handy, or the heavy weights. Choice wethers are used in the same way as prime wethers, and both are sought by dealers in high-class mutton.

Good wethers are characterized by coarseness and lack of prime condition. They do not command the highest prices because they do not dress a high percentage of marketable meat nor yield a quality of mutton satisfactory to a high-class trade. If wethers are pronounced in their weight of pelt, but covered with thick fat, they will come in this grade unless of undesirable weight. Frequently wethers of choice condition and quality, and weighing 120 to 135 pounds, are placed in the good grade because their weight is not adapted to the purpose for which they are desired. They are too heavy for light, handy purposes, and too light for heavy carcass purposes.

The common grade is made up of wethers of inferior quality and in perceptibly underfinished condition.

Ewes.—In this subclass are included yearling ewes, surplus breeding ewes, and those no longer useful for breeding purposes.

As these different sources indicate, there are wide differences in the age, condition and weight of the various offerings of ewes appearing on the market.

Ewes do not sell on a par with wethers, because they have proportionately a greater percentage of offal and a smaller amount of lean meat. Except in times of urgent demand for mutton, prime wethers sell for at least 50 cents per hundredweight more than prime ewes. However, when the demand for mature mutton is strong the difference is often no more than 25 cents. * * *

Smooth, highly finished native and western yearling ewes, and a very small number of well-bred, aged native ewes, of prime quality and in prime condition, comprise the offerings in [the prime] grade. Since the bulk of yearling ewes are sold for breeding purposes, the total offerings of prime ewes are small. Prime yearling ewes may be not entirely above criticism in quality and condition, but

because they are light in weight they meet with ready sale. The strongest demand is for weights not greater than 100 pounds. However, large, smooth, aged ewes in prime condition sell as prime ewes. * * *

Ewes of [the choice] grade must show development to a high degree in form, quality, and condition, as they are placed to the same use as prime ewes. They may be slightly faulty in quality, condition, or weight, but they are usually criticised for their lack either of quality or condition. Grain-fattened western ewes frequently sell as choice.

Good ewes are appreciably open to criticism in condition and often in quality. In most seasons of the year ewes choice in condition and quality, but of the unhandy weights ranging from 115 to 130 pounds, are also placed in this grade.

Underfinished condition and advanced age are usually evident in the medium grade. "Often ewes and their lambs are sent to market together. Ewes in such shipments are frequently too low in condition to be above the medium grade."

Offerings of the common or cull grade are pronounced in their lack of condition.

Toothless old ewes, too decrepit to make use of feed, and thus regain desirable condition, are slaughtered for the cheapest class of trade. As the winter season advances a number of ewes appear on the market well advanced in pregnancy. Such ewes, although they may be of choice quality and condition, sell as common ewes because of their high percentage of waste and the ill effects pregnancy is said to have upon the color of the carcass.

BUCKS AND STAGS.

On the market rams are designated as "bucks." Stags are males castrated later than the lamb stage of life, and they sell on a par with bucks. Strictly speaking, bucks are not graded, although the terms "choice," "good," and "common" are frequently used.

FEEDER SHEEP.

Whenever sheep are too low in condition to suit the needs of the packer, they fall into the feeder class, unless they be extremely coarse in quality or weakened in vitality because of disease or advanced age.

The heavy run of feeder sheep occurs in the months of September, October, and November, when rangemen are reducing their flocks and preparing for the winter months. However, buyers are constantly looking for thrifty, underfinished stuff and a limited number of feeder sheep go out from the markets every week in the year. * * * Practically all the sheep sold as feeders are grown on the western ranges. * * * The following are the recognized subclasses of feeder sheep: Lambs, yearlings, wethers, ewes.

Lambs.—Feeder lambs are those thin in flesh left after sorting out those in a band in suitable condition for the mutton trade. The grades recognized on the market are fancy selected, choice, good, medium, common, or inferior.

Fancy selected feeders must not only possess the characteristics of choice feeders, as noted [below], but in addition they must be uniform in breeding

aud markings and show au unusual amount of muttou blood for range lambs. Their quality, as evidenced by clear-cut features, clean limbs, light and smooth pelts, must be practically above criticism. They are nearly always slightly higher in condition and heavier than the average run of feeder lambs, ranging in weight from 65 to 70 pounds, and in that state of thrift where gains can be placed on them rapidly. If properly handled, they are the grade of feeders that will finish quickly into prime lambs. Not many of this grade of feeders are to be found on the markets. * * *

Choice feeders will develop into choice and prime mutton lambs if properly managed. Of the grades that come to the notice of buyers generally, they are probably more uniform than any other, and in order to get a fixed standard from which to make comparisons, this grade is described in detail.

What the buyer expects of choice feeders is the ability to finish into prime or choice mutton lambs, and to produce gains at economical figures. The selection of such lambs is based upon form, quality, constitution, condition, and weight.

In general, the form should be deep, broad, well knit, of medium length and low set. This conformation indicates early maturity, good constitution, capacity for growth, and a likelihood of finishing into an attractive carcass with a relatively high percentage of valuable cuts. * * *

Quality is a very important consideration in the selection of feeder lambs, and it is that characteristic which is manifested by a medium-sized, fine, clean-cut head; medium-sized and moderately thin ears; the hair on the face and legs fine and silky; bone that is fine and without coarseness at the joints; skin thin and without folds or wrinkles. A smooth skin without folds or wrinkles and carrying wool of moderate weight is the most important requirement of desirable quality in feeder lambs. * * *

The conformation which indicates a strong constitution was described above under "Form." A wide, deep chest, fullness in the heart girth, depth and breadth of body indicate sufficient space for well-developed vital organs, or strong constitution. Another important point, which if not a part of constitution is closely akin to it, is thrift. The intelligent buyer of choice feeders rejects all lambs that appear in the least unthrifty, such as lame ones and those inclined to lag behind when the band is moving.

Choice lambs should be fairly full in their outlines and without any suggestion of emaciation. Choice feeder lambs range in weight from 55 to 62 pounds.

Good feeder lambs are usually more leggy and coarse than those that are considered choice. Lambs weighing between 50 and 55 pounds and choice in form, but somewhat, although not excessively, heavy in pelt, are placed in the good grade.

Lambs of the medium feeder grade often have very heavy pelts, and hence lack appreciably in quality.

Pronounced legginess and angularity of form are frequently noticeable in bands of lambs grading as medium, but the chief discrimination is against their quality because of their thick, wrinkled skins and dense, heavy fleeces. While in most cases they are thrifty, they are usually below the weight most desirable in feeder lambs, and this, together with their lack of quality and desirable form, places them considerably below the choice feeder.

The lambs most common to the grade of common or inferior feeders are little, light, late-born, weak lambs.

They are known under several appellations, such as "bums," "culls," "pewees," and "peanuts." Their weight may vary anywhere from 25 to 45 pounds, and because of their tender age, light weight, and weakened condition they require skillful care and a long period of feeding upon nutritious feeds that will produce a large amount of growth as well as fat.

The demand for this grade is limited.

Yearlings.—This class is made up exclusively from yearling wethers. They do not figure prominently in the feeder trade. They are graded as choice, good, common.

Wethers.—Of the wethers sold from the range for feeding purposes the greater number is shipped direct to western feed lots, hence the supply on the Chicago market is extremely meager. The grades are choice, good, medium, common.

To be considered choice feeders, wethers must be of good conformation, highly developed in quality, and uniform in weight and condition. * * * The choice feeder wether should be of a light, handy weight, which ranges from 80 to 90 pounds.

Good feeder wethers should be uniform in weight and condition, and not open to serious criticism in conformation and quality. Wethers of this grade are usually inferior to those of the choice grade in quality or condition.

Wethers of the medium feeder grade are usually criticised for their lack of quality and condition. Medium feeder wethers are likely to be large of frame, and although not heavy at the time of purchase because of their thin condition, they are heavy wethers when marketed as mutton.

Extremely coarse wethers with heavy pelts, stags, the result of castrating mature rams, and very old wethers are included in the common feeder grade.

Ewes.—"When there is a slow demand for breeding ewes * * * the yearling ewe lops off into the feeder class. Of the mature ewes sold as feeders, the larger number are those that have spent their usefulness as breeders on the range. They vary considerably in condition, quality, and general thrift, and all feeder ewes may be graded as follows: Choice, good, medium, common."

Most of the yearling ewes offered as feeders are placed in the choice grade.

They are of choice quality and in that degree of condition at which gains are put on rapidly and early give a degree of desirable finish. They weigh from 70 to 80 pounds and when finished yield a neat, handy weight carcass. Smooth, aged ewes of good form and in medium flesh are also placed in this grade.

To grade as good, feeder ewes must be smooth and healthy, and their teeth must be sound.

Ewes of the medium feeder grade may be lacking either in quality or thrift. If unthrifty, they are usually broken mouthed and in low condition.

Common ewes are very old and so depleted in condition that they approach emaciation. As a rule their front teeth are gone or worn so low that they are of little use. Only the best of care and feed will secure gains on ewes of this grade.

BREEDING SHEEP.

Native and western ewes are included in this class in about equal proportions, but breeding bucks are exclusively natives.

Ewes.—The ewes most sought after are 2, 3, and 4 year old dark-faced natives in ordinary field condition. * * * Many of the ewes offered for breeding purposes are yearlings, but they are not as desirable as 2 or 3 year old ewes, because they are immature and likely to be unsatisfactory as mothers at their first lambing. The native yearling is heavier and more nearly mature than the western yearling, and she meets with a correspondingly better sale. The offerings on the market come under the following grades: Fancy selected, choice, good, common.

Only a very few of the breeding ewes sold out of the market can be regarded as fancy selected. * * * Such ewes are high grades of some of the Down breeds, usually Shropshire, and in addition to being thrifty and sound, they are uniform in quality, conformation, fleece, and style.

The greater number of the more desirable breeding ewes are of the choice grade. Choice ewes should be 2, 3, or 4 years old, sound in mouth and udder; Down breeds preferred.

The smooth, low-set, symmetrical ewe is preferred over the angular, upstanding ewe with uneven top and lower lines. * * * Choice breeding ewes should have smooth, rather refined features and bone of medium size. * * * While choice breeding ewes should be thrifty and active, fat is not desirable. * * *

Several factors combined cause breeding ewes to grade as good, such as undesirable markings, age, weight, conformation, and condition.

Common breeding ewes are on the border line between breeders and feeders. They show no single line of breeding. In many instances they are noticeably advanced in age.

Bucks.—While the rams sold out of Chicago market as breeders vary in age, weight, and markings, there are no recognized grades. Those most sought after are dark-faced, smooth, low-set, vigorous-looking rams of a year or more in age. * * * Inspection of rams selected for breeding out of the open market reveals the fact that the greater percentage show undesirable form and a mixture of breeding.

MISCELLANEOUS.

Hothouse lambs (spring lambs).—The term "hothouse lambs" refers to those produced early and marketed before the general run of spring lambs start to market, which is about May 20. * * * "Hothouse lambs" are most in

demand from Christmas until Easter. They must be fat and weigh between 40 and 55 pounds.

Export sheep.—Most of the sheep selected for export are the heaviest of their class. They are usually in prime condition and of the choice grade. Wethers are preferred, but ewes, yearlings, and lambs are also taken, hence the term "export" can not be said to apply to any particular subclass of mutton sheep. Many buyers use the term freely to designate wethers, yearlings, ewes, and lambs heavy in weight and prime in condition, whether they be taken for export or not.

Throw-outs.—This is a term applied to lambs rejected as feeders. After a band of lambs has been divided into the mutton and feeder classes, the purchaser of the feeder end usually has the privilege of rejecting those not suitable for feeding purposes. Lame lambs, those appearing unthrifty, entire males, those large enough to be suspiciously near the short yearling age, and frequently black lambs make up the rejections. * * * Throw-outs are often called "rejects," but they are never known as "culls" or by any of the terms which denominate the grades under the regular classification. Sometimes they sell on a basis of cull lamb prices, at other times upon that for medium lambs.

Dead sheep.—These are sheep that meet with death in transit. Losses are greatest in warm weather, when deaths are frequent if close crowding in the car is practiced. * * * Dead sheep have a value chiefly for their wool. The best are worth 25 cents per head. It is claimed that 50 per cent of them are worthless on account of the wool being mangled and trampled off.

Goats.—Goats are sold for slaughter provided they are in good condition, but they do not sell on a par with sheep. Only a few are sold on the Chicago market, and hence they are not graded.

The different classes and grades which have been described are summarized in the following table:

Summary of classification of sheep.

Classes.	Subclasses.	Grades.
Mutton sheep (native and western sheep)	Lambs	Prime.
		Choice.
		Good.
		Medium.
		Common or culls.
	Yearlings	Prime.
		Choice.
		Good.
	Wethers	Prime.
		Choice.
		Good.
		Common.
	Ewes	Prime.
		Choice.
		Good.
		Medium.
		Common or culls.

Classes.	Subclasses.	Grades.
Feeder sheep (western sheep)	Bucks and stags	Choice.
		Good.
		Common.
	Lambs	Fancy selected.
		Choice.
		Good.
		Medium.
		Common.
	Yearlings	Choice.
		Good.
		Common.
	Wethers	Choice.
		Good.
		Medium.
		Common.
	Ewes	Choice.
		Good.
		Medium.
		Common.
Breeding sheep (native and western sheep)	Ewes	Fancy selected.
		Choice.
		Good.
		Common.
	Bucks	(Not graded).

Miscellaneous:

Hothouse lambs.
Export sheep.
Throw-outs.
Dead sheep.
Goats.

VETCH HAY AND VETCH SILAGE AS FEEDS FOR COWS.[a]

Common vetch (*Vicia sativa*) is a great nitrogen gatherer and is used as a farm crop in many different ways. In some localities it has proved valuable as a catch crop and also as a cover crop in orchards. In France it has been grown to furnish honey-making material for bees. In the eastern United States the common vetch has not proved to be so valuable as other legumes, but in western Oregon it has become a standard stock feed and is used as hay, silage, pasture, and as a soiling crop. It makes a very palatable hay and dairy cattle prefer vetch silage to that made of red clover. On some farms vetch is replacing clover in the regular rotation. Vetch is usually sown in the fall with wheat or rye to support the stalks, and is cut for hay when the seeds begin to form in the pods. Under western

[a] Compiled from Oregon Sta. Buls. 85, 91, 102; Rpt. 1905.

Oregon conditions of soil and climate it yields from 2 to 4 tons of hay to the acre. The seed crop yields from 15 to 30 bushels per acre.

Vetch is a heavy feeder on soil potash. At the Oregon Station the per cent of ash found in water-free vetch was 8.2. The ash contained 37.5 per cent of potash and 10.02 per cent of phosphoric acid. Calculating at the rate of 3 tons of cured hay to the acre, a crop of vetch will remove 150 pounds of potash and 40 pounds of phosphoric acid. As a dairy feed vetch is prized for its high protein content, though it is quite variable. In 10 samples examined in 1903 protein varied from 14.63 to 21.31 per cent, with an average of 17.39 per cent; in 80 samples examined in 1904 protein varied from 12.19 to 23.31 per cent, with an average of 18.03 per cent; and in 152 samples examined in 1905 protein varied from 9.65 to 25.52 per cent, with an average of 18.85 per cent.

In experiments with cows at the Oregon Station the digestibility of the protein of vetch hay varied from 61.07 to 69.91 per cent, of carbohydrates from 70.71 to 71.59 per cent, and of fat from 68.01 to 71.21 per cent. The digestibility of the protein of steamed vetch silage was 14.62 per cent, of unsteamed vetch silage 56.38 per cent; of the carbohydrates of steamed vetch silage 62.83 per cent, of unsteamed vetch silage 66.85 per cent; of the fat of steamed vetch silage 62.91 per cent, of unsteamed vetch silage 77.34 per cent.

From these experiments it will be seen that vetch hay and vetch silage must be considered as valuable protein feeds for dairy stock, and that steaming vetch silage reduces its digestibility. "Over 56 per cent of the protein in the unsteamed silage is digested, while less than 15 per cent of that in the steamed silage is utilized by the animals. The average per cent of dry matter, ash, fiber, and fat digested is from 10 to 14 per cent lower in the steamed silage. The digestibility of the extract, or carbohydrates, is approximately the same in each."

DIGESTIBILITY OF KALE.[a]

Thousand-headed kale (*Brassica oleracea*), introduced into the Willamette Valley, Oregon, twenty-seven years ago, has become one of the most valuable succulent dairy feeds in the State. It received the name "thousand-headed" because of the numerous branches when given plenty of room in which to grow. It does not head up like cabbage, but looks more like rape, though the plants are taller and the leaves are longer and broader. The plant can endure cold weather,

[a] Compiled from Oregon Sta. Buls. 91 and 102; Ontario Agr. Col. and Expt. Farm Rpt. 1907, p. 217; U. S. Dept. Agr., Bur. Plant Indus. Bul. 94.

and in the Oregon climate stands in the field all winter. It is hauled to the barn and fed green from October to April at the rate of 25 to 50 pounds per day to each animal. In the early part of the feeding season only the lower leaves should be used, as there will be too much loss in feeding the whole plant. Kale should not be fed when frozen, nor should it be allowed to remain in piles where it will heat, and it must be fed just after the milking period to avoid tainting the milk. A single plant sometimes weighs 30 pounds. A yield of 30 to 40 tons of green kale to the acre is not uncommon. At the Ontario Experiment Station, from 1904 to 1907, the average yield of thousand-headed kale per acre was 27.1 tons; of hardy curled kale, 20.3 tons; Jersey kale, 19.8 tons; tall green curled Scotch kale, 19.3 tons.

Chemical analyses made at the Oregon Experiment Station show kale to be very rich in protein and mineral matter. One hundred pounds of fresh kale contained 11.3 pounds of dry matter, 2.4 pounds of protein, 0.53 pound of fat, 4.98 pounds of carbohydrates, 1.54 pounds of fiber, and 1.84 pounds of ash.

Calculated to the acre yield of 30 tons, these values show that approximately 225 pounds of potash and 115 pounds of phosphoric acid enter into the composition of each acre of kale. This shows the plant to be a heavy feeder on these plant foods and proves the necessity of a rich soil for its successful growth.

At the same station feeding experiments were made with cows to ascertain the digestibility of kale. Fresh kale was fed in amounts varying from 50 to 80 pounds per cow per day. The average per cent digested was as follows: Dry matter, 68.01; protein, 80.63; fat, 65.85; carbohydrates, 75.83; fiber, 58.99; ash, 38.81, indicating that "a large proportion of the protein in the kale is digestible, an average of 80.63 per cent being obtained from the four tests. The percentage of digestibility of the other constituents is also normal or above, with the exception of the ash."

HULLED CORN.[a]

In a recent bulletin of the Maine Station, L. H. Merrill says:

By treating corn with an alkali the hull or indigestible outer coating of the kernel may be so loosened that it can be easily removed. If the alkali is then thoroughly removed by washing and the product steamed, the result is the so-called "hulled corn," a very acceptable food with many.

In view of the fact that little or nothing is actually known of the digestibility of hulled corn as compared with similar articles of diet, Professor Merrill made a number of careful tests of the digestibility of the material when eaten with milk only and with a mixed ration of bread, butter, meat, and canned peaches. The composition of the

[a] Compiled from Maine Sta. Bul. 158.

hulled corn used in the experiments were as follows: Water, 80.24 per cent; protein, 1.9 per cent; fat, 1.05 per cent; carbohydrates, 15.04 per cent; fiber, 0.2 per cent; and ash, 1.57 per cent.

The digestibility of the hulled corn as determined in the experiments is shown in the following table in comparison with that of white (wheat) bread:

Digestibility of hulled corn and white bread.

	Protein.	Carbohydrates.
	Per cent.	*Per cent.*
Hulled corn, simple diet (average of 8 experiments)	81.7	97.3
Hulled corn, mixed diet (average of 8 experiments)	90.9	97.0
Hulled corn alone (average of 8 experiments)	61.2	96.4
White bread, simple diet (average of 7 experiments)	93.9	99.1
White bread alone (average of 7 experiments)	92.6	98.9

The above table shows that the protein of the hulled corn is much less digestible than that of the white bread, and that the carbohydrates (sugars, starches, etc.) are slightly less digestible, but that the hulled corn is more digestible when eaten in a mixed diet than when eaten alone or in a very simple diet. The latter fact illustrates a general truth, viz, that many food materials are more digestible when eaten in a mixed diet than when used alone.

METHODS OF MIXING FAT INTO DOUGH.[a]

The effect on quality of mixing fat into dough in different ways has been studied by Miss M. U. Watson, of the Ontario Agricultural College, who found in the case of biscuits in which the shortening had been mixed in the dough by rubbing or cutting into the flour, and by also mixing in the melted shortening, that equally good results were obtained as regards outward appearance and the way the dough had risen, but on breaking the biscuits made with melted butter they were found to be of inferior texture and seemed very tough, while in the biscuit in which the butter was rubbed into the dough the texture was much better, more spongy, and quite tender.

When these methods of mixing in fat were tested with cookies the samples were found to be very much alike after baking, one being as good as the other.

[a] Compiled from Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 33 (1907), p. 244.